# Fluid dynamics video of domains with spiral dislocations formed in the wake of an enslaved phase-separation front

A.J. Wagner and E.M. Foard
*Department of Physics, North Dakota State University, Fargo, North Dakota 58108, USA*
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Enslaved phase-separation fronts that move with a speed just smaller than that of a free front will leave in their wake a morphology of alternating domains that are roughly aligned with the front. However, these alternating domains will typically not be in phase initially. Instead there are defects. Here we present novel phase-separation morphologies that are formed in such systems where the defects are reminiscent of spiral dislocations in crystal growth.

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Phase-separation occurs when a control parameter, e.g. a concentration, is changed beyond its critical value. This process typically happens non-homogeneously so that a phase-separation front moves through the system. If the speed of the front is controlled by the advancement of the control parameter, we refer to this front as an enslaved phase-separation front. We consider here the simplest case of such an enslaved phase-separation front, an abrupt change of the control parameter moving with constant speed through the system.

In one dimension, such a system will lead to alternating domains[1]. In two dimensions the domains can be either aligned with the front, or orthogonal to the front, depending on the front speed. For fronts not much slower than the natural front speed, i.e. the speed of a phase-separation front moving into an unstable medium, the domains tend to align with the phase-separation front. In three dimensions the domains aligned with the front will have some defects. These defects are in the form of spiral dislocations. In the movie SpiralDislocations we see a phase-separation front slowly advancing toward the observer. An initially random pattern soon organizes into a large number of dislocations. These dislocations interact in a non-trivial manner, often switching from attraction to repulsion. Occasionally two spiral dislocations with opposite chirality will annihilate. This process leads to a slow reduction in the number of dislocations. The resulting morphology is a bi-continuous structure of spiral lamella which is punctuated by the spiral dislocations. Snapshots of the animation are shown in Figure 1.

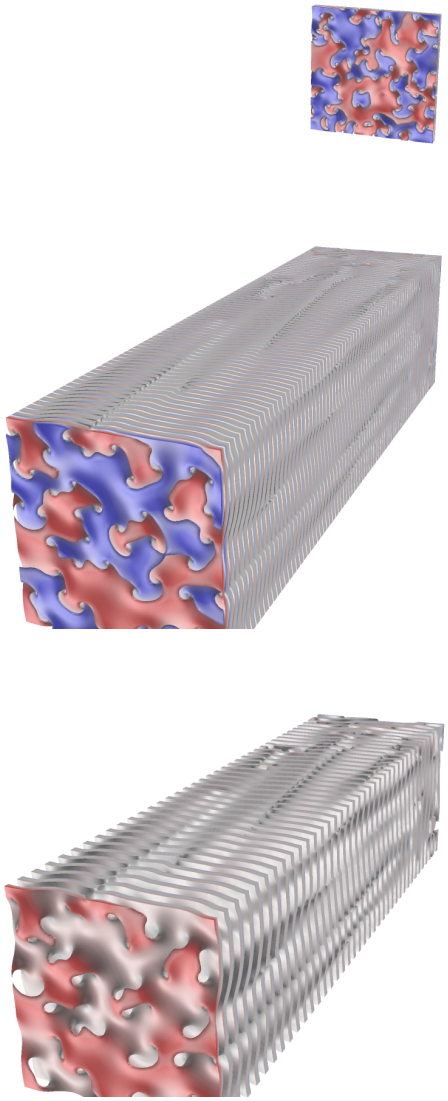

FIG. 1: Phase separation front moving towards the observer generates a near lamellar morphology with defects reminiscent of spiral dislocations. The last graphics shows the morphology after one phase has been removed.

[1] E.M. Foard and A.J. Wagner, *Phys. Rev. E* **79**, 056710 (2009).